

pupil), the hypertrophy of the interureteric ligament and the fine trebeculations usually located in the lateral portion of the first and second bladder zones.

But, until recent years, our knowledge of the more precise nerve supply and physiology of the bladder was sadly deficient, and while the standard textbooks dealt independently with this subject, it remained for the French anatomists to conclude investigations which led to the application of surgical measures for the relief of certain nervous lesions affecting the bladder. In 1930 Pieri applied neurectomy for the treatment of incurable, painful, tubercular cystitis, and in more recent years Learmonth, Foulds, Van Duzen, and Cheetham, have extended its use to the various types of neurogenic bladder, pointing out its indications and contraindications. The extensive studies of Young and Wesson, Van Duzen and Looney, Trabucco, Dragonis, and others on the anatomical structure and physiology of the bladder have been most useful. The cystometric studies of Rose, Redewell, and of Lewis and Langworthy, enabled us to diagnose more accurately disturbances of the motor pathways of the nervous system supplying the bladder.

In dealing with the neurogenic bladder, a rational form of therapy should be used for the different lesions due to the various disturbances of vesical function. For the treatment of the hypofunctioning external sphincter, cold baths, plastic operation, etc., are advised. For hypofunction of the trigone muscle in which the detrusor action is normal adrenalin is used in order to stimulate the sympathetic nerves. In hyperfunction of the trigone with weakened detrusor muscles, presacral neurectomy is employed. In this condition, Learmonth has justly pointed out that the parasympathetic nervous innervation acts as a brake on vesical contraction and resection of these nerves releases the brake. An analysis of the results obtained by presacral neurectomy seem to point out that it is indicated in a selected group of cases of sympathetic parasympathetic unbalance, spasms of the internal sphincter and incurable painful lesions of the bladder.

The discovery, and the use of the choline derivatives for stimulation of the parasympathetic nerve supply of the bladder are most interesting. On the administration of 2.5 mg. hypodermically, one notes flushing of the face, sweating, salivation, increased pulse, fall in blood pressure, increased peristalsis, etc.; in other words, the phenomenon produced by parasympathetic stimulation, accompanied by vasodilatation. In using this drug in the treatment of neurogenic bladder, one finds that it had a favorable action in decreasing residual urine in patients with neurogenic dysfunction. We have observed favorable results from the administration of this drug, noting that it acted by stimulation of the parasympathetic nerve fibres, increasing the tone of the detrusor muscle, resulting in improved emptying of the bladder.

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ORIGINAL ARTICLES

BIRTH INJURIES TO BLADDER AND BOWEL *

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EARLIEST mention of vesicovaginal fistulae probably occurred in the Ebers Papyrus. Hippocrates (460-377 B. C.) spoke of the involuntary discharge of urine following childbirth, but made no mention of its cause. Guillemeau, in the sixteenth century, first attempted surgical union of complete tear, while Van Roonhuyse (1672) probably made the first surgical attempt to close a vesicovaginal fistula. Certainly these major birth injuries to the bladder and bowel have been recognized for a long time, long before any attention was paid to birth traumata of lesser degree. Intervening centuries have seen gradual additions to both prevention and remedy. The development of cesarean section, forceps, version and more significantly perhaps, prenatal care, are today important factors in preventing these parturitional accidents.

CLASSIFICATION OF BIRTH INJURIES TO BLADDER AND BOWEL

These may be conveniently divided into the major and minor, depending on amount of damage; thus:

1. *Major*.—Extensive tearing or avulsion of either bladder or bowel.

(a) Vesicovaginal fistula or other damage to the urinary tract sufficient to cause diversion of the urinary stream.

(b) Complete tear of the perineum (third degree), *i. e.*, lacerations involving the anal sphincter and/or rectum, resulting in fecal incontinence.

2. *Minor*.—The lesser injuries to the bladder and bowel fall into two groups, the immediate and remote. Among the former (immediate) are acute hemorrhoids; fissures and bladder paralysis. More important, however, are the remote sequelae, which include cystocele, rectocele, urinary incontinence (muscle paralysis) hemorrhoids, etc.

PREDISPOSING FACTORS

While the cause is obviously trauma, usually resulting from disproportion between the birth canal and fetus, certain predisposing factors should be recognized. These may be classified as follows:

Intrinsic.—Including underdevelopment and anomalies of generative tract, abnormal pelvis, large baby, malpresentation, tetanic contractions, distended bladder, etc.

Extrinsic.—Forced labor (pituitrin or other uterine stimulants). Operative manipulations (both necessary and unnecessary).

By recognizing these factors and instituting or planning proper treatment, serious damage is generally prevented. Certainly the incidence of serious

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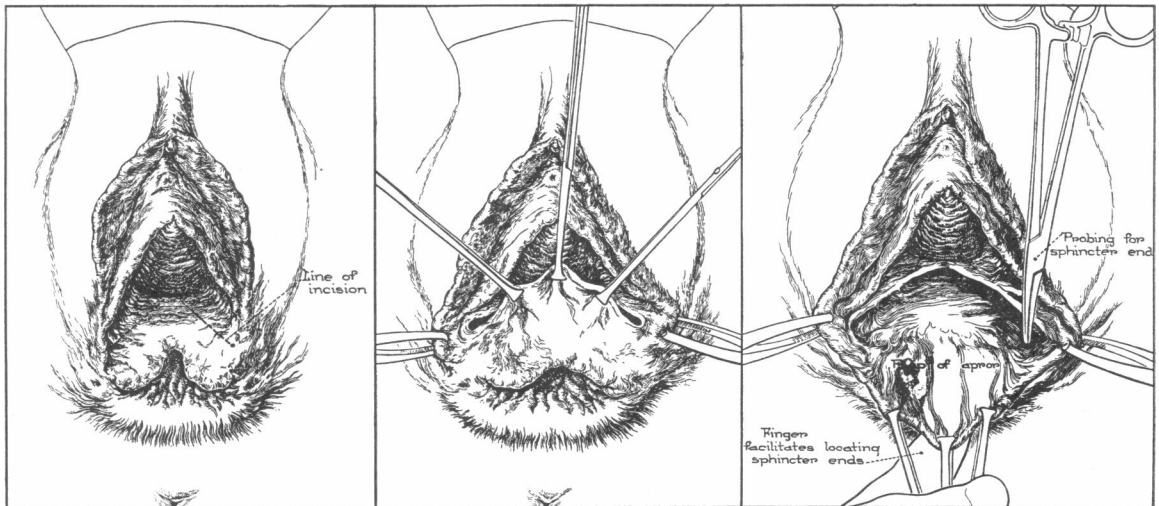


Fig. 1.—Flaps outlined by dotted line.

Fig. 2.—Flaps developed.

Fig. 3.—Probing for sphincter ends.

birth injury, particularly to the bowel, is such as to suggest either unfamiliarity with these predisposing causes or else abundant disregard for their potentialities as a source of trouble. Adequate prenatal care should reveal intrinsic factors likely to cause disproportion or excessive trauma, but prenatal care cannot compensate for understanding and judgment during delivery. The advisability of keeping the bladder and bowel empty during normal labor becomes an essential when operative delivery is planned. Failure to do so has resulted in bladder or bowel injuries which are sometimes incorrectly attributed to the use of forceps. Doubtless the unskilled use of instruments or other operative measures may lead to injury, but more often the primary cause lies elsewhere. Serious damage to the bladder is probably more often prevented than caused by the intelligent use of forceps. This is particularly true in excessively long labors, where the danger of pressure necrosis is very real.

One cannot consider prevention even in its most elementary form without mentioning episiotomy.

The value of this operation in preventing birth injury need not be questioned. On the other hand, the average episiotomy probably does little to prevent remote sequelae to the bladder. When ordinarily done the occiput has already traversed the entire length of the anterior vaginal wall and the damage, if any, to this region has already occurred. In the average confinement, let this valuable procedure be justified by what it actually accomplishes, namely, shorter labor for the patient, conservation of time for the doctor, and a controlled, rather than an uncontrolled, perineotomy.

The minor injuries to bladder and bowel make a fascinating study. Remote sequelae in the form of urinary incontinence, though seldom serious, is nevertheless aggravating and its remedy far from simple. Time and space do not permit comprehensive consideration of all birth injuries and we shall, therefore, delimit the rest of this discussion to remedial measures for the more serious and less tolerable conditions, vesicovaginal fistula and complete perineal tears.



Fig. 4.—Sphincter ends grasped. Only the more recent cases permit such free isolation of sphincter ends.

Fig. 5.—Approximation of sphincter ends.

Fig. 6.—Sphincter sutured.

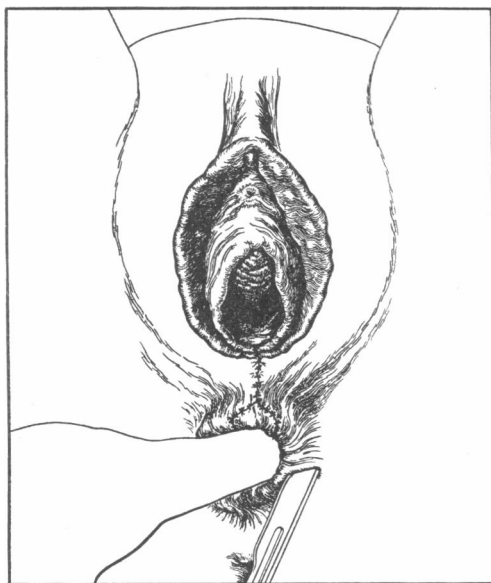


Fig. 7

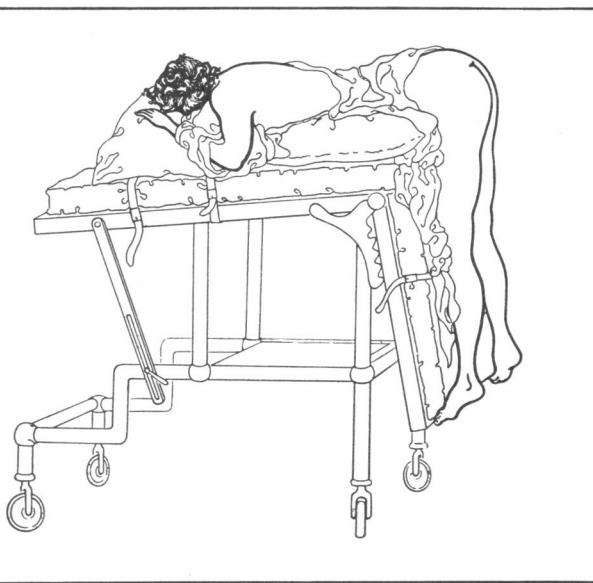


Fig. 8

Fig. 7.—Perineum reconstructed and sphincter incised subcutaneously in a posterior lateral quadrant. This permits the anteriorly united ends to heal without tension.

Fig. 8.—Inverted Trendelenburg position used in exposing and repairing vesicovaginal fistula.

Since palliation is seldom indicated the treatment becomes a surgical problem. While the physical pain associated with these lesions is not great, the mental anguish is such that few conditions cause greater misery and unhappiness. This, together with the fact that every attempt at repair resulting in failure renders the chances for healing at the time of subsequent operation much less likely, warrants caution in undertaking their repair. Those contemplating this type of surgery should become thoroughly familiar with the indications and contraindications of the many operative techniques available. The importance of preparation and thorough understanding of the basic principles underlying this type of surgery cannot be overemphasized. While preparation of the patient for operation depends on whether the lesion involves the bladder or bowel, the principles underlying surgery of this kind are fundamentally the same.

BLOOD SUPPLY

Fortunately the pelvic organs are normally quite vascular, so that interference with healing because of poor circulation is seldom noted except in badly scarred cases with excessive cicatrix formation. Each failure following repair leaves in its wake increased scarring and decreased vascularity. This accounts for the well-recognized difficulty of obtaining primary union in patients who have undergone many operations. Not only do the tissues heal poorly, but the infection hazard also becomes increasingly great because of this lack of circulation. This is not the only circulatory hazard, however, for too early operation or surgery attempted in the presence of inflammation is occasionally associated with excessive bleeding, even to the point of jeopardizing the result. Many repairs have been complicated in this way. One of our own fistula patients bled so profusely during operation that it was necessary to give a blood transfusion.

TENSION

A second fundamental principle to be observed in the management of these major injuries is the avoidance of excessive tension. In the repair of bladder fistulae this is best accomplished by means of remote incisions. In old, badly scarred fistulae the incision is made parallel to the vagina on either side and some distance lateral to the fistulous opening. In complete tears the sphincter is incised as shown.

INFECTION

Bugaboo of every operation, infection plays a less significant rôle in the healing of vesicovaginal fistulae than in complete tears. Immunity to organisms normally harbored in the vagina probably accounts for the few failures from this cause. Abundant evidence confirming this fact is to be found in the remarkable records established by such men as Wützer, Jobert, Simon, and Sims long before the days of Pasteur and Lister.

EXPOSURE

Generally speaking, this is no problem in complete perineal tears. In the case of bladder fistulae, however, one finds a variety of available approaches, three of which are worthy of consideration. Most common and, in our opinion, safest as well as easiest in the vast majority of cases, is the vaginal approach. This is best accomplished by placing the patient in the inverted Trendelenburg position, thus permitting the surgeon to look directly down upon the fistulous opening. The transvesical and transperitoneal avenues, undoubtedly useful, are, in our opinion, best reserved for those cases in whom the vaginal approach is for some reason unsatisfactory. That great and almost forgotten master in fistula surgery, Wützer, recognized the ease with which bladder fistulae could be seen by tipping the patient face down, and

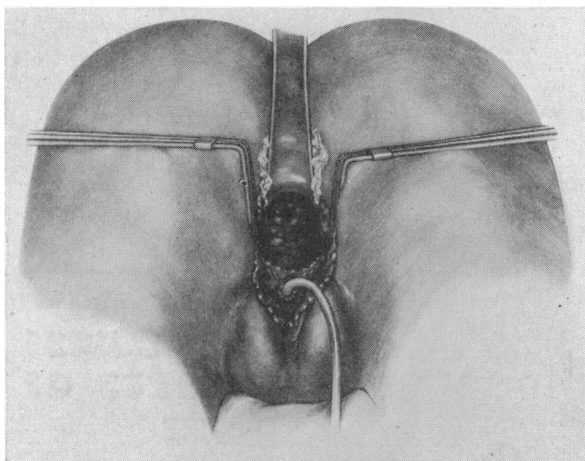


Fig. 9.—View of fistula as seen with the patient in the inverted Trendelenburg position.

devised a special bed for this purpose. Bozeman did the same, while Sims utilized the knee-chest position.

SUTURING

One cannot consider the fundamentals of repair without giving some attention to suture material and methods. In the first successful work of this character, metallic sutures were used. Sims popularized the use of silver wire and for many years this was standard procedure in our country. Early in the present century, however, the enthusiasm for absorbable material became so great as to result in its almost complete substitution for the metallic suture. Time has scarcely justified such complete change. While the modern suture is both bactericidal and bacteriostatic, desirable features provided they do not damage normal tissue, there is evidence to suggest that tissue injury has occurred from this source in the past, and undoubtedly accounted for some operative failures. Another point for emphasis in suturing is tissue approximation and not strangulation. Healing depends on not how tightly the sutures are tied, but on preparation of the tissues and their careful coaptation. Too much suturing is a common fault. While I do not use wire for these cases, I see no objection to its employment.

PREPARATION FOR OPERATION

Since there is no emergency involved, operation too soon after the accident is to be avoided.* Unless the tissues have regained their normal health, the likelihood of primary healing is remote and, consequently, every effort should be made to return the injured parts to normal health before attempting operation. This means general upbuilding, as well as local cleanliness and antisepsis. In general, operation should not be undertaken for at least three months after the injury occurred or a previous unsuccessful attempt at closure.

TECHNIQUE OF OPERATION

As previously pointed out, the operator should thoroughly familiarize himself with the various techniques available and select from these the procedure most suitable for his particular patient. The

* Excepting immediate repair.

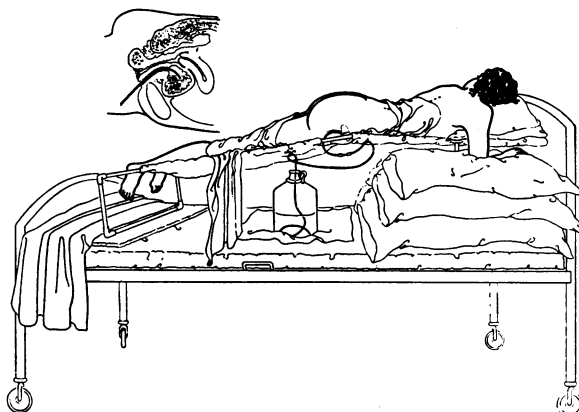


Fig. 10.—Frame utilized in the postoperative care of vesicovaginal fistula. There should be a sufficient opening in the frame underneath the abdomen to permit some sagging of the abdominal wall. Note that the repaired area is above the urine level in the bladder. This tends to minimize gross wetting.

technique used by us in the repair of vesicovaginal fistulae and complete tears is shown in Figures 1 to 10.* It will be noted that good exposure of the bladder fistula is obtained by utilizing the inverted Trendelenburg position (Figures 8 and 9). Tension on tissues approximated is avoided by wide mobilization of the fistula or by means of lateral incisions.

In the case of complete tears, tension on the freshly united sphincter ends is avoided by cutting of the sphincter muscle in one of the posterior quadrants. In long-standing cases where there is difficulty in approximating the sphincter ends anteriorly, this posterior cutting may be performed first. In most cases, however, this is done after completion of the operation to which we have applied the name, "paradoxical repair."¹

AFTER-CARE

Minor differences in after-care need not be discussed here; generally they have little influence on healing, and are merely an expression of the surgeon's likes and dislikes. We do, however, consider avoidance of gross wetting to the site of repair a valuable aid to healing in vesicovaginal fistula. To this end, the patient is placed on a frame, face down, as illustrated in Figure 10. By so doing the operative site remains above the urinary pool. I do not consider the prone position in bed without a frame a satisfactory substitute. Both fistulae and complete tear cases receive only liquid diet for the first ten days after operation, and no enemas or cathartics during this time. Otherwise the after-care is similar to that generally practiced for any average surgical case.

Much of the hopelessness surrounding serious major birth injuries to both bladder and bowel is unnecessary. Given thorough understanding of the problem involved, and judgment in selecting time and method of operation, a great deal can be done to restore the damaged generative, alimentary and urinary tracts. Every vesicovaginal fistula, and

* Figures 1 to 7 show the various steps in the author's Paradoxical Operation for Complete Tear.

¹ Miller and Brown: Paradoxical Repair of Third Degree Tears, *Am. J. Obst. and Gyn.*, Vol. 34, No. 2, p. 196 (Aug.), 1937.

every complete tear of the perineum should be looked upon as a major problem of the highest order. The possibilities of prevention are very real, and should everywhere be recognized by physicians practicing obstetrics. The suffering caused by these major birth injuries and their remedial difficulties call for meticulous attention to every detail of operative correction.

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USE DESTRUCTION IN THE HUMAN BODY*

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WITH respect to the topic under discussion, I think it is fair to say that we have been in the position of a physiographer, whose eyes are fixed upon earthquakes as the sole factor in topography.

Much has been written about joint mice, for example, the severe pathological process or the violent movement which may produce them, and the sudden painful effects which may accompany them. The fact that an innumerable number of joint mice present in diarthroses cause no symptoms, and that their number can be increased by movement, has been largely forgotten. Neither the production of these nor their presence becomes known to the individual, and except in so far as they were regarded as fragments of hyaline articular cartilage, supposedly contributing to the formation of synovia, no special significance was attached to them. Yet their existence is as significant in regard to the integrity of the articulations concerned as is that of erosion to topography. However, the microscopic and macroscopic particles contained in synovial fluid are not all derived from hyaline cartilage, but come from the capsules, ligaments and fibrocartilage as well, and under unusual conditions may arise from muscles. The presence in synovia, from diarthroses, of particles transitional in size between large incapacitating joint mice and minute microscopic particles, is a matter of special significance and was considered briefly elsewhere.¹ These particles, like the larger incapacitating joint mice, also have a traumatic origin, though not in the customary sense of the word, for they are the products of attrition.

Other bodily changes which I believe to have a similar origin are such phenomena as are discussed in the following:

SUPERFICIAL AND DEEP SYNOVIAL BURSAE

1. Fraying and destruction of the walls of the superficial and deep synovial bursae. These phenomena are commonest in such superficial bursae as those overlying the olecranon and the patella, as shown in Figures 3, 4, 5, 6,¹ and in such deep bursae as those about the shoulder, particularly the subdeltoid or subacromial, and the size of the frayed areas and the depth of the destruction vary greatly. As is well known, there may be a subacromial and

a subdeltoid bursa in the same adult shoulder, but there may also be none. Since Black² found that the first bursa in this region develops subacromially, that designation would seem preferable. It is such also, because it is absent less rarely than the subdeltoid bursa; but since the latter portion of the single or combined bursae usually is considerably larger, the latter designation represents the usual conditions better.

It would be easy to arrange a progressive series from the well-preserved, smooth, normal bursa to one the entire thickness of the synovial wall of which was completely eroded from within, and the bounding connective tissues, muscles or tendons of which are frayed. These phenomena can be seen even in the bursa of the iliopsoas, as shown in the accompanying Figures 1 and 2, and on the deep surface of the obturator internus, as represented in Figure 3. Slight fraying of the walls of the synovial bursae is invariably present somewhere after the third decade of life, and can easily be recognized without the aid of a hand lens. Indeed, it could be detected in some bursae of a youth of thirteen who had not been unusually active, and in whom related disease could be excluded.

The existence of superimposed bursae, or their formation where only one is normally present, as in the region of the olecranon and in that of the great trochanter, furnishes conditions permitting the partial destruction, fasciculation and fraying of the interbursal walls, as shown in Figures 7³ and 5.¹ What is surprising, at first, is that all this may happen without the presence of bursal content of any kind, save the usual amount of synovia, and small fragments of the shredded tissues, if the bursae have not enjoyed so long a period of rest that the particles have undergone comminution and lysis.

FRAYING OF ARTICULAR CAPSULES

2. Fraying on the inner surfaces of articular capsules, also referred to in 1915,⁴ is the commonest change within articulations. As shown in the case of the capsule of the knee joint represented in Figure 21,⁵ this fraying can be very pronounced in an otherwise perfectly normal joint. It is found where the articular capsules come into contact with the margins of the articular cartilages, and the common presence of these capsular fringes somewhere suggests that some of the synovial villi of surgical literature probably belong in this category. This fringing may be present over a considerable area of the inner surfaces of the articular capsules, and usually is more pronounced on the right side of the body, as illustrated in Figures 4 and 5. It often is extremely marked in the radiocarpal articulation, as represented in Figure 20,⁵ and is commonly present at the margins of the plica mucosa of the knee. Broader but exceedingly thin capsular tags with frayed margins, the detachment of which would yield free bodies akin to those referred to above, frequently form a part of these fringes.

ARTICULAR CAPSULE DEFECTS

3. In addition to fringes within and without articular capsules, the latter may contain small and large defects. These occur most frequently in the shoulder, the acromioclavicular and the hip joints,

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